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# Appropriate use of oral drops: perception of health professionals and assessment of package insert information

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**Key words**
oral drops – perception of health professionals – package insert

**Abstract.** Objectives: To evaluate the perception of health professionals and industry personnel towards the appropriate use of oral drops and to assess their package inserts with regard to presence of proper instructions for use and storage. Methods: The first part was a cross-sectional self-administered questionnaire. The questionnaires were distributed randomly to physicians, pharmacists and decision makers in local pharmaceutical companies. In the second part, the package inserts of medications with oral drops were reviewed to check for presence of proper instructions for storage and proper use. Results: The majority of physicians and pharmacists (73.3% and 71.2%) thought that oral drops can be delivered from the dropper directly into the patient's mouth. 60.8% of physicians and 54.3% of pharmacists thought that the dropper should be clamped vertically when oral drop are dispensed. 72.7% of industry personnel agreed that the angle of inclination affects the drop size. Many of these personnel said their companies did not perform the recommended tests for dose uniformity and calibration. Instructions for storage and proper use were not available in package inserts of many oral drop products in Palestine. Conclusions: Health professionals should have complete and correct information regarding all factors that affect the proper delivery of oral drops and should counsel patients on the proper method of delivery. Pharmaceutical companies should take into consideration the formulation issues that may affect drop size and provide leaflets and labels with complete and correct instructions on the proper use and storage of oral drops. Package insert information in oral drops needs to be more comprehensive with regard to instructions for use and storage.

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## Introduction

Oral liquid dosage forms are widely used, especially in pediatric and geriatric care. The medications are given as oral liquids to facilitate their swallowing, reduce the risk of inhalation, and make their administration easier [1, 2, 3]. Many parents are faced with the daily challenge of getting their children to take a medicine [4]. Recent findings indicate that many adverse drug events in pediatric outpatients can be attributed to errors in dose calculation and improper administration [5, 6]. The inaccurate dose of the medicine can thwart the benefits of even the most powerful drug resulting in sub-therapeutic under-dosing, adverse drug events due to overdosing, and inadequate duration of treatment as a result of overdosing [3]. Several studies have discussed optimizing oral medications for children by improving the taste [7] or the accuracy of dosing devices [3, 5, 8]. It is important to use the proper device appropriately in order to get the correct dose. It is not recommended to use household spoons to administer liquid medications because they vary in shapes, sizes, and forms leading to dosing errors [8, 9].

Currently there appears to be no set guidelines or instructions regarding the use of oral drops. Previous work to study the accuracy of dosing from dropper bottles mainly included studies examining the drop volume delivered from ophthalmic droppers [10, 11, 12]. Several physico-chemical components determine the size of the drop delivered: the surface tension, viscosity, density, temperature, and cohesive forces of the solution dispensed [10, 12]. During the instillation of a drop, the dropper should be held vertically to provide uniform drop size [10, 11]. Brown et al. recommended that, in order to ensure accuracy of dosing, patient information should confirm that containers must be held vertically when

delivering drops, and that drops should be delivered onto a spoon or some other appropriate device and not directly into the patient's mouth [13]. This method prevents the dropper from coming in contact with the mouth (keeping it free from contamination), and allows for easy monitoring of the number of drops dispensed from the dropper prior to taking the product. This is especially true when the product contains a drug with a low therapeutic index.

Great efforts are done to develop communication skills between health professionals and patients to improve patient outcomes and reduce medication errors [14, 15, 16]. Package inserts have an important impact on patient compliance and proper use of medications and thus on the effectiveness of the drug in use [17]. Regardless of all efforts to improve the readability and comprehensibility, by both the drug regulatory authorities and the manufacturers, package inserts are still criticized [18]. The aims of this study were to evaluate the perception of Palestinian health professionals and industry personnel towards the appropriate use of oral drops, and to assess the package inserts of oral drop products with regard to presence of instructions for use and storage.

## Methods

The first part of this study was a cross-sectional self-administered questionnaire. The questionnaires were distributed during October and November 2009. The questionnaires were composed of 3 sections. In the first section, the community pharmacists were asked to fill in the trade names of oral drops present in the Palestinian market, their manufacturing companies, and the active ingredients contained in each product. In the second section, health professionals (physicians and pharmacists) were asked to comment on five statements regarding the proper use of oral drops which included (1) the method of holding the dropper bottles or droppers when a dose is administered, (2) delivering the oral drops onto a spoon or (3) directly into the patient's mouth, (4) the effect of temperature fluctuation on volume and weight of the dispensed drop, and (5) a general statement about providing patients with instructions regarding the proper use of oral drops. The questionnaires were distributed randomly in various areas of the West Bank by pharmacy students. They were asked to choose community pharmacists and physicians from their living areas and were encouraged to apply a 1:1 ratio of physicians to pharmacists if possible. The third section was designed to be answered only by decision makers in the major four local pharmaceutical companies and aimed to assess their knowledge regarding some relevant aspects. These included the effect of angle of inclination on the drop size, the performance of certain tests on their formulations including the European Pharmacopoeia (EUP) test for dose uniformity of oral droppers [19], and the United States Pharmacopeia (USP) calibration test for dropper formulations [20], in addition to viscosity and interfacial tension testing. They were also asked whether they thought their companies provided instructions for use of oral drops in labels and leaflets of their products. The study included all decision makers in the 4 major local companies producing oral drops. In the second part of the study, the package inserts of all oral drop products present in the Palestinian market were reviewed to check for presence of instructions for storage and proper use. After collection of the filled forms, the data was entered and descriptively analyzed using the Statistical Package for the Social Sciences (SPSS) software program version 16.0.

## Results

### *Oral drop products and their package insert information*

23 active ingredients under 38 trade names were found in the Palestinian market. Instructions for storage before opening the medication were available in 33 (86.8%) products, while instructions for storage after opening the medication were available in 3 (7.9%) products only. Instructions to hold the dropper vertically during medication administration were available in 9 (23.7%) products. Instructions to administer the medication onto a spoon first and not directly into the patient's mouth were seen in 21 (55.3%) products out of the 38 studied.

Table 1. Data obtained from health professionals regarding the appropriate use of oral droppers.

| Question | Agree % | Disagree % | Uncertain % |
|---|---|---|---|
| Container of oral drops should be clamped in vertical position when medications are administered. | | | |
| Physicians (n = 131) | 60.8 | 23.8 | 15.4 |
| Pharmacists (n = 150) | 54.3 | 21.4 | 24.3 |
| Oral drops should be delivered onto a spoon. | | | |
| Physicians (n = 131) | 29.8 | 57.3 | 13.0 |
| Pharmacists (n = 150) | 31.4 | 56.4 | 12.1 |
| Drops can be delivered directly into patient mouth. | | | |
| Physicians (n = 131) | 73.3 | 19.1 | 7.6 |
| Pharmacists (n = 150) | 71.2 | 23.7 | 5.0 |
| Temperature fluctuation can affect the volume and the weight of a drop. | | | |
| Physicians (n = 131) | 60.0 | 25.4 | 14.6 |
| Pharmacists (n = 150) | 60.7 | 17.1 | 22.1 |
| Instructions about proper use of droppers should be given to patients. | | | |
| Physicians (n = 131) | 90.8 | 9.2 | 0.0 |
| Pharmacists (n = 150) | 91.4 | 4.3 | 4.3 |

## *Perception of physicians and pharmacists*

Almost all the physicians and pharmacists who were asked to answer the questionnaire, accepted to do so. Only 6 physicians and 10 pharmacists refused to fill the questionnaire giving a response rate of 95.6% and 93.8%, respectively. The questionnaire was distributed throughout various areas of the West Bank where it was filled by 131 physicians and 150 community pharmacists. As it can be seen from Table 1, a high percentage of the physicians (60.8%), and about one half of the pharmacists (54.3%) thought that the container should be clamped vertically when dispensing oral drops. The majority of physicians and pharmacists (73.3% and 71.2%, respectively) thought that oral drops should be delivered from the dropper directly into patient's mouth. This result was confirmed when physicians and pharmacists were asked if the patient can deliver the oral drops onto a spoon prior to administration. Here, a minority of physicians and pharmacists (29.8% and 31.4%, respectively) agreed with this practice. In this study, almost equal numbers of physicians and pharmacists (60.0% and 60.7%, respectively) agreed that temperature fluctuation can affect the volume and the weight of oral drops. The majority of physicians (90.8%) and community pharmacists (91.4%) agreed that instructions about the appropriate use of droppers should be given to patients.

## *Viewpoints and observations of industry personnel*

All the industry personnel (22) who were approached agreed to answer the questionnaire. As it can be seen in Table 2, a high percentage of them (72.7%) agreed that the angle of inclination affects the drop size delivered, while only 40.9% thought that the drop size is reduced when droppers are inclined more towards the horizontal position. 45.5% of the personnel stated their companies did not perform the European Pharmacopoeia (EUP) test for dose uniformity of oral droppers with 90.0% of them stating that the reason behind this was the lack of obligation from regulatory bodies (i.e. the ministry of health-MOH). A United States Pharmacopeia (USP) calibration test for dropper formulations can be done to ensure the exact knowledge of drop volume, and in our study, only 68.2% of the personnel said they performed this test in their companies. Again, the reason behind not performing this test was the lack of obligation

Table 2. Data obtained from industrial personnel (n = 22) regarding the oral droppers.

| Question | Yes No. (%) | No No. (%) |
|---|---|---|
| Do you agree that the angle of inclination affects drop size? | 16 (72.7) | 6 (27.3) |
| Do you agree that as the droppers are inclined more toward horizontal position, drop size is decreased? | 9 (40.9) | 13 (59.1) |
| Does your company perform EUP test for dose uniformity of oral droppers? | 12 (54.5) | 10 (45.5) |
| If your answer is NO can you state why? | | |
| There are no obligations to do it from regulatory bodies | 9 (90.0) | |
| The company doesn't know such a test exists | 0 (0.0) | |
| The company doesn't think it is a necessary test | 1 (10.0) | |
| Does your company perform the USP calibration test for dropper formulations? | 15 (68.2) | 7 (31.8) |
| If your answer is NO can you state why? | | |
| There are no obligations to do it from regulatory bodies | 7 (100.0) | |
| The company doesn't know such a test exists | 0 (0.0) | |
| The company doesn't think it is a necessary test | 0 (0.0) | |
| Does your company perform viscosity testing for every batch of oral drop formulation? | 21 (95.5) | 1 (0.5) |
| If your answer is NO can you state why? | | |
| There are no obligations to do it from regulatory bodies | 0 (0.0) | |
| The company doesn't know such a test exists | 0 (0.0) | |
| The company doesn't think it is a necessary test | 1 (100.0) | |
| Does your company perform interfacial tension testing for every batch of oral drop formulation? | 7 (31.8) | 15 (68.2) |
| If your answer is NO can you state why? | | |
| There are no obligations to do it from regulatory bodies | 9 (60.0) | |
| The company doesn't know such a test exists | 1 (6.7) | |
| The company doesn't think it is a necessary test | 5 (33.3) | |
| Does your company provide leaflets and labels of oral drops with instructions containing clear information about proper use of oral droppers? | 21 (95.5) | 1 (0.5) |
| If your answer is NO can you state why? | | |
| The company doesn't think it is necessary | 0 (0.0) | |
| There are no obligations to do it from regulatory bodies | 1 (100.0) | |
| There are no complaints about lack of such information | 0 (0.0) | |

from regulatory bodies. Viscosity testing for every batch of oral drops was found to be widely performed among the 4 companies (95.5% of them conducted it), while only 31.8% of them reported performing interfacial tension testing for every batch, 60% of them said the reason was due to lack of obligation from regulatory bodies. 21 of the personnel (95.5%) believed their companies provided leaflets and labels of their oral drop products with instructions containing clear information about their proper use.

## Discussion and conclusion

### *Discussion*

Oral liquid dosage forms are widely accepted and used, especially in pediatric and geriatric care [1, 2]. Their efficacy depends highly on the correct dosing and handling. The dose in these products is determined and measured in terms of a certain volume of the product. The inclusion of various types of dosing

devices in oral liquid medication packages is aimed at improving dosing efficiency [8].

Oral drops are available and widely used in Palestine. Thus, understanding the appropriate use of droppers becomes of high importance especially, when these formulations contain potent drugs or drugs with low therapeutic indices [13]. After reviewing the package insert information of the products in our market, it was found that most of them (33) (86.8%) included information regarding the suitable storage before opening but only 3 (7.9%) products mentioned the suitable storage conditions and duration after opening the product. It is important to explain the storage conditions well, and if these conditions are the same after opening the medication, this needs to be confirmed because unsuitable storage can affect the physico-chemical properties of the medications which can alter not only the drop size but also the stability of the product. Instructions to hold the dropper vertically during medication administration were available in 9 products out of 38 (23.7%). This shows that the majority of the package inserts and labels ignored the significant effect of the angle of inclination of the dropper on the size of the drop delivered [10, 11]. Instructions to administer the medication onto a spoon first and not directly into the patient's mouth were seen in 21 products out of the 38 studied (55.3%). This method is important not only to monitor the number of drops dispensed from the dropper prior to taking the product, but also to prevent product contamination from the mouth. Although some package inserts contained information and illustrations to explain the proper way of medications, still this information needs to be included in the remaining products.

About one half of the participating pharmacists and 39.2% of physicians, had different opinions from what we expected regarding the statement which says that the container should be clamped vertically when dispensing oral drops. This result implies that the safety or the accuracy of these dosage forms among the patients may be compromised, and thus reduce success opportunities of the therapeutic treatment. In fact, the non-vertical clamping of the dropper reduces the volume and consequently the weight of the delivered oral drops [10, 13] which may result in sub-therapeutic response. This may lead to undesired problems such as bacterial resistance if the medication is an antibacterial or antiviral [3]. Furthermore, poor patient compliance may arise when the patient has no improvement in his medical condition due to the sub-therapeutic doses.

Regarding the practice of delivering oral drops from the dropper directly into the patient's mouth, the majority of physicians and pharmacists (73.3%, 71.2%, respectively) declared their agreement with this point. This result was confirmed when health professionals were asked if oral drops should be delivered onto a spoon before oral administration, where a minority of them (31.4% of the pharmacists and 29.8% of the physicians) agreed with that. These unexpected results are of great importance since patients who follow this wrong practice may suffer from toxic dosages when the number of delivered drops is higher than that prescribed. Concerning the effect of temperature fluctuation on the volume and the weight of oral drops, most physicians and pharmacists (60.0% and 60.7% respectively) agreed that temperature fluctuation can affect the volume and the weight of the dispensed drops. Thus, it is important to include information on proper storage temperatures in the package inserts and labels of oral drops before and after opening. Moreover, the majority of health professionals agreed with the importance of package inserts being provided with full information about the correct use and storage of oral drops. This shows that more detailed and comprehensive information in the package inserts and labels will be welcomed.

It was interesting to see that a high percentage of decision makers in the pharmaceutical industry did not have very clear information regarding the effect of angle of inclination of droppers on the drop size dispensed. This fact might explain to a certain extent the results shown in the remainder of the questionnaire. It can be seen that local pharmaceutical companies which did not perform the EUP test, the USP test, nor interfacial tension testing actually ignored these tests merely because there was no obligation to perform them by regulatory bodies and they did not consider these tests as important quality control measures to be performed on their products. Viscosity testing on the other hand was acknowledged to be conducted routinely in all of the 4 companies. In our opinion, it is imperative

that the local pharmaceutical companies should be better informed on the importance of conducting such tests and to include them as routine quality control measures for their products.

## Conclusion

From the results obtained in the current study, we recommend some measures which may lead to better outcomes for both the pharmaceutical industry and the patient. Health care practitioners should have complete and correct information regarding all factors that affect the accurate delivery of oral drops and should counsel patients on the appropriate method of administration. Pharmaceutical companies should consider the formulation issues which may lead to drop size variability and consider performing the relevant tests that are necessary to ensure high standards of quality of their products. They should also provide their products with comprehensive and correct instructions about the proper use and storage of droppers, preferably accompanied with illustrations when possible. Regulatory bodies should consider adopting more strict measures for quality control of formulations, and oblige manufacturers to follow them and to provide comprehensive package insert information with their products.

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